Life on Mars- Extracting the Signs for Future Human Habitation on the Red Planet

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- Signs of Life Found on Mars and Similarities with those signs on Earth
- Utilizing Life Support Resources present on Mars for human habitation

INTRODUCTION

1- Rise of Global Warming and it's alarming consequences which might cause complete loss of life on Earth– Search for an Earth like habitable body in the outer Space

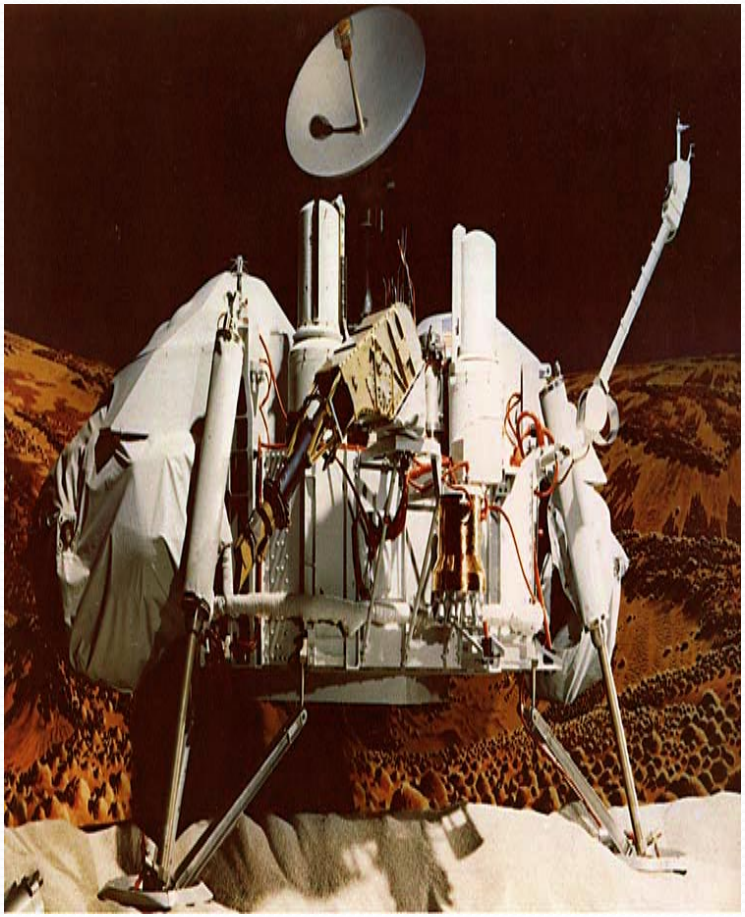
2- Ongoing Exploration of Mars in search of Life on the Red Planet for future human habitation on the planet.

3- Mars is the planet which is very similar to Earth and it's believed that Life had existed on Mars in the Past– Big support to our quest for life in the future

4- The life supporting features found on Mars are very similar to those found on Earth– Giving a sign of prospective life in the near future on Mars

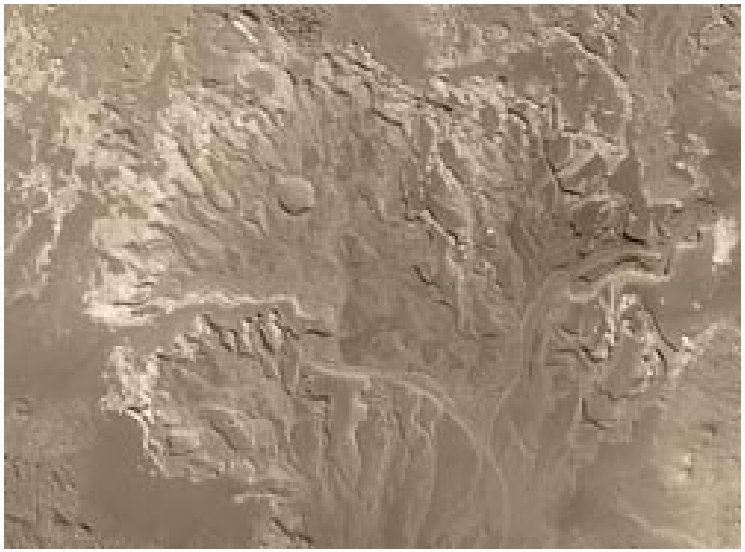
Life on Mars

- Life on Mars has been a subject of wide discussion from the very early beginning. There has been speculations about the existence of Life on the Red Planet in the Past
- But still about the presence of an Earth like habitable environment on Mars is a BIG QUESTION **?**
- **The first search for Life on Mars was carried out by NASA's VIKING LANDER in 1976**
- Gas Chromatograph/Mass Spectrometer Instrument on the Lander detected the possible **MICROBIAL LIFE** in the soil sample .
- The question about MICROBIAL LIFE remains unresolved



LIQUID WATER ON MARS

- The speculation about the presence of LIQUID WATER on Mars has been a subject of deep interest to the scientists from the very beginning
- As it's believed in order to support LIFE, the need of WATER in LIQUID FORM is MUST..
- It's believed that WATER once used to flow on the planet when it was WARM.
- The features found on Mars and their similarity to those on Earth supports that WATER indeed USED to FLOW on Mars in the past.
- But the present condition on Mars which is VERY COLD– RULES OUT the possibility of WATER in LIQUID FORM in the present time.
- DELTA formation on Mars and Earth-

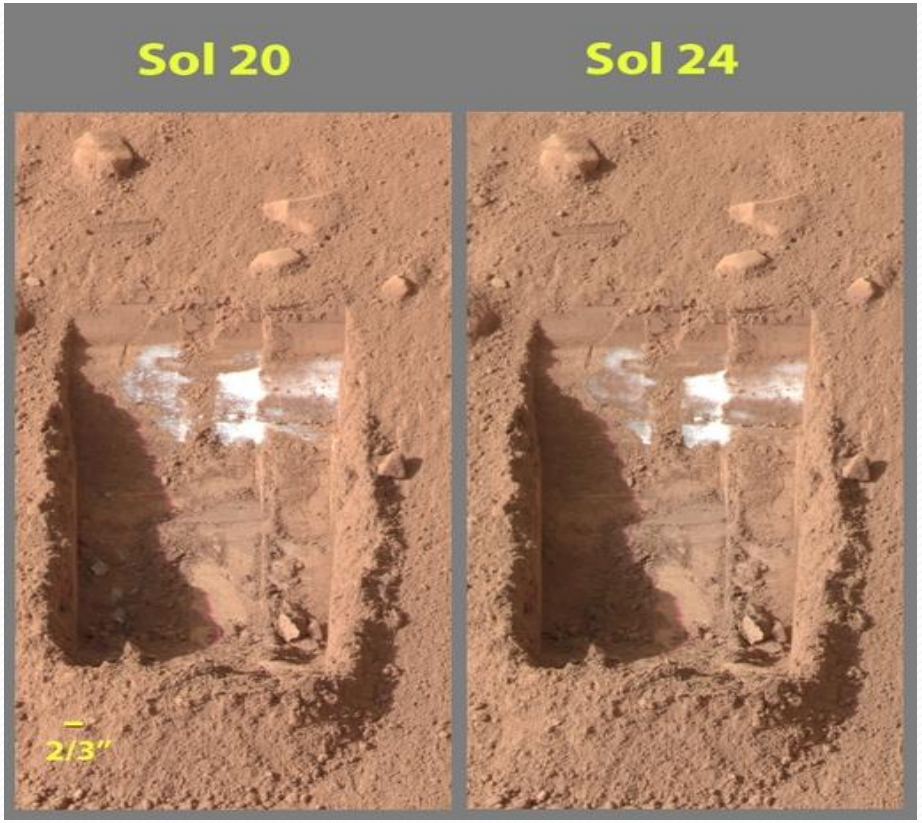


Top Image- : Eberswalde Delta on Mars- Mapped by Mars Global Surveyor

Bottom Image- : Lena River Delta on Earth- Mapped by LANDAT-7

WATER ICE ON MARS

- The confirmation about the presence of WATER ICE on Mars by NASA' Phoenix Lander in 2008 gives another indication that water once flow on Mars when it was WARM.
- Since it's cold now hence the WATER has frozen on the Planet



1- The color images acquired by NASA's Phoenix Mars Lander's Surface Stereo Imager on the **21st and 25th** days of the mission, or Sols 20 and 24**(June 15,2008 and June 19,2008**).

2- These images show **SUBMILATION OF ICE** in the trench informally called "Dodo-Goldilocks" over the course of four day.

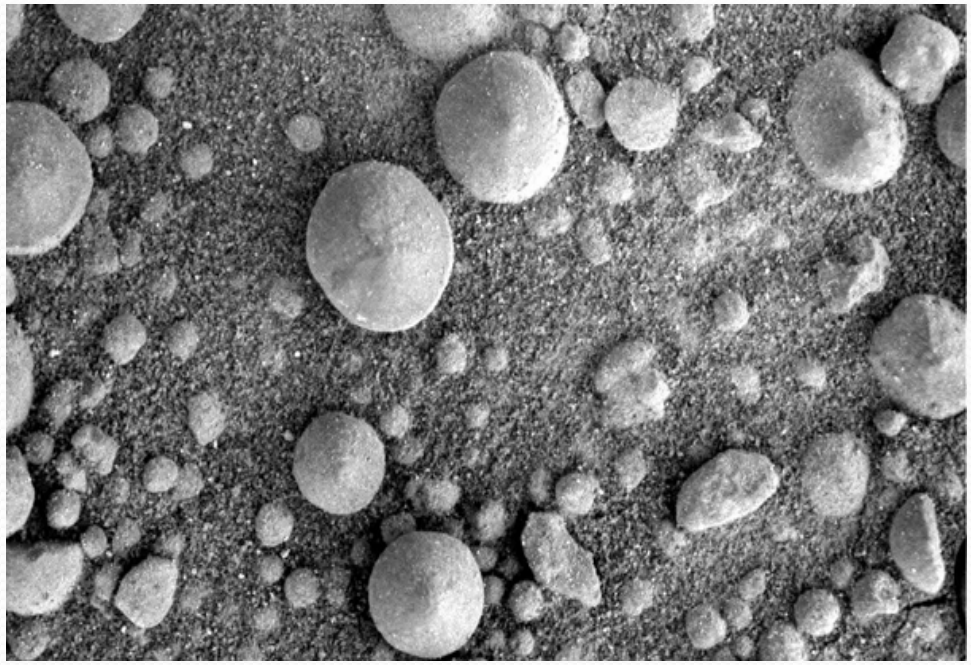
3- In the lower left corner of the **LEFT IMAGE**, a group of **LUMPS** is visible. In the **RIGHT IMAGE**, the **LUMPS** have disappeared, similar to the process of **EVAPORATION**

MICROBIAL LIFE ON MARS

- Scientists believe that the simplest form of life that can be found on Mars is in the form of MICROBES.
- The Viking Lander in 1976 detected the first possible presence of Microbial Life on Mars.
- The small iron shaped BLUEBERRIES found in the Martian rocks may have been formed from the MICROBES
- The small spherical hematite balls, dubbed "blueberries" were first discovered by NASA's Opportunity Rover in 2004 in the Martian soil.

On Earth, such spherical iron-Oxide concretions are commonly found on **beaches and deserts** around the world. Similar examples to those discovered on Mars have been found in the **Jurassic Navajo Sandstone** near the **Colorado River, Utah.**

Blueberries spotted by NASA's Opportunity Rover, 200 meters north of Victoria Crater on Mars

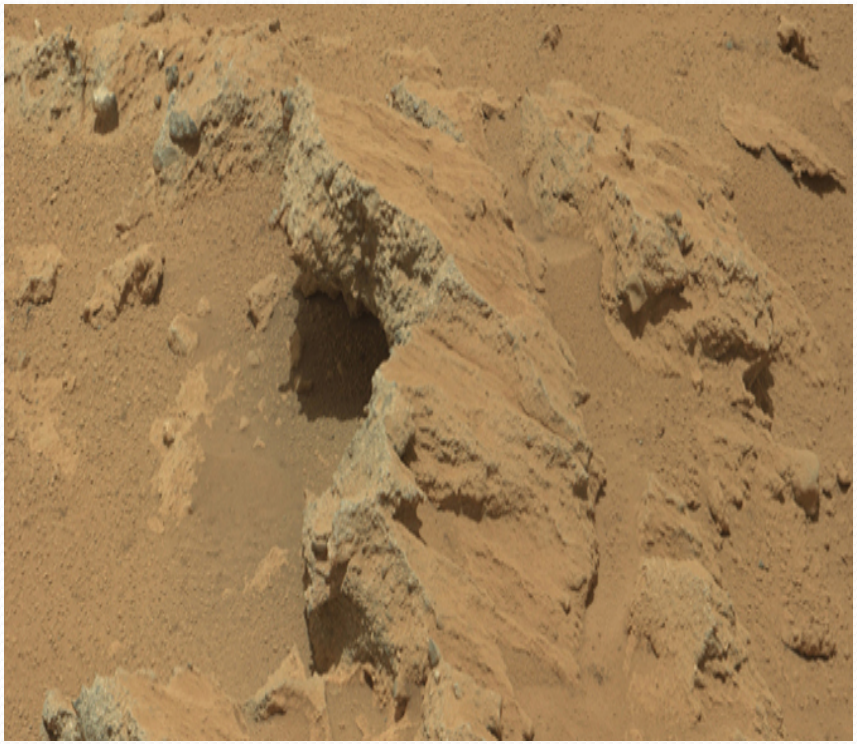


- Researchers from the University of Western Australia and University of Nebraska have found that such iron-oxide spheroids, when they appear on Earth, are formed by MICROBES
- The research was published in the August,2012 issue of *Geology*
- The scientists at both universities have showed that there is a clear relationship between the spheres found in Utah and biological elements such as CARBON and NITROGEN
- They found microstructures within the Utah concretions that were consistent the remnants of bacteria, such as the iron-oxidising ***Gallionella***

Iron-oxidising ***Gallionella bacteria***

STREAMBED ON MARS

- NASA's Mars Science Laboratory "Curiosity" discovered Ancient Water STREAMBED on the Martian surface.
- There is earlier evidence of presence of Water on Mars, but this evidence- images of rocks containing ANCIENT STREAMBED GRAVELS- is the FIRST of its kind found on Mars



Rover Found the Evidence that-

1- Stream once ran Vigorously across the area on Mars.
2- Size of Gravels it carried, it can be interpreted that water was moving about **3 Feet per second**
3- Depth somewhere between ankle and hip deep
4- The Rounded shape of some stones indicate– **Long Distance transport**
5- Abundance of Channels suggests flow continued or repeated over a **LONG TIME.**

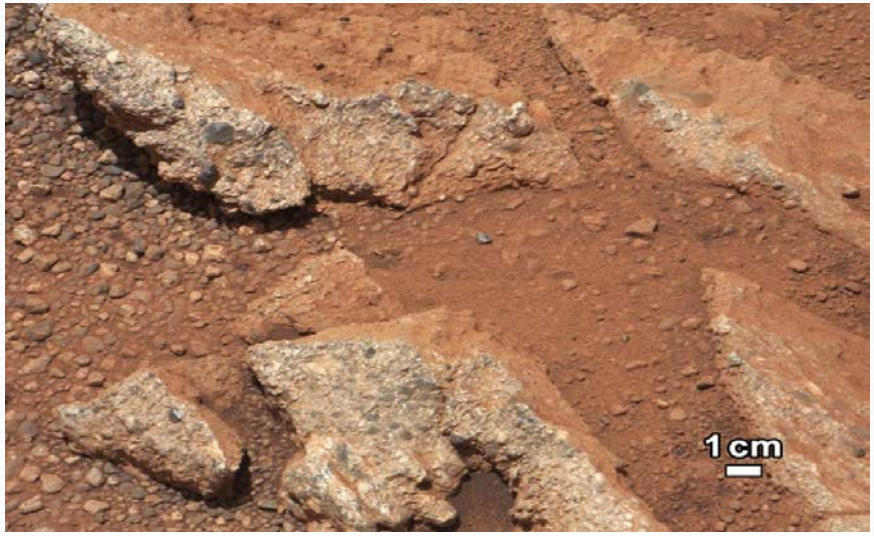
FOSSIL LIFE ON MARS

- The meteorites falling on Earth have shown the composition of microorganism giving a strong indication of life on Mars in the past. Scientists believe that the early life on Earth started from the small microorganism.
- the possible existence of microorganism in the composition of meteorites shows the possibility of existence of life on Mars.
- One such meteorite named ***ALH84001*** was found in Antarctica in 1984. The study of this rock showed that it contains fossilized evidence of microbial life.
- In their paper in *Science* Magazine, Dr. David McKay of NASA and his co-workers gave evidence that ***MARTIAN BACTERIA*** may have lived in the Martian meteorite ALH 84001

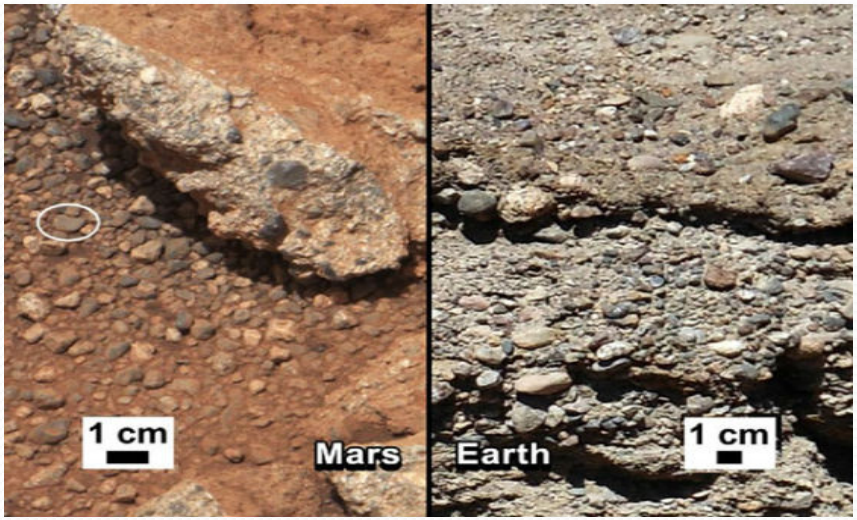
ROCK OUTCROP found on Mars by NASA' Curiosity Rover- PROOF of POSSIBLE WATER TRANSPORT

1- The OUTCROP characteristics are consistent with a sedimentary conglomerate, or a rock that was formed by the deposition of water and is composed of many smaller rounded rocks cemented together.

2- WATER TRANSPORT is the ONLY process capable of producing the rounded shape of CLASTS of this size

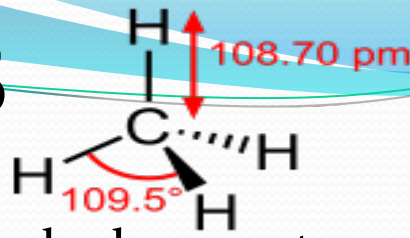


Rock outcrop called Link pops out from a Martian surface that is elsewhere blanketed by reddish-brown dust.



This set of images compares the Link outcrop of rocks on Mars (left) with similar rocks seen on Earth (right)

METHANE ON MARS



- Methane, made of one Carbon and four hydrogen atoms, is one of the simplest organic compounds.
- On Earth, **90 to 95 percent** of Methane in the atmosphere comes from ***Biological activity***, mainly ***Methanogenic*** bacteria and ***cow farts***.
- As a result, many researchers regard Martian Methane as a possible indicator of ***Red Planet life***.
- The traces of Methane on Mars was first reported by a team of scientists at ***NASA' Goddard Space Flight Center in 2003***.
- In order to analyze the Martian air, the most advanced Rover to Mars "Curiosity" carried SAM (Sample Analysis Measurement) Instrument
- ***Non detection*** of Methane on Mars in its first few sniffs of the Red Planet air by NASA' recent active rover Mars Science Laboratory "Curiosity" casts doubt on previous claims of Methane hotspots due to microbes on Mars.
- ***Non detection*** of Methane suggests ***no modern*** day microbes on Mars

EXTRACTING LIFE SUPPORTING COMPOUNDS FROM THE RESOURCES ON MARS

- The life supporting compounds on Mars can be extracted from the resources present on the Martian surface.
- The life supporting breathable air requires two components: Oxygen and a suitably inert buffer gas.
- On Mars, the most likely candidate buffer gas is a mixture of ***Ar*** and N_2 which together make up about **5%** of the Martian atmosphere.
- Processing gases and liquids is much simpler and reliable than handling solids.
- Furthermost the concentration of CO_2 and Ar/N_2 in the atmosphere are virtually constant with the day and season.

CONCLUSION

- The signs of life being discovered by the robotic missions to Mars-- Strong background about the possibility of existence of life on Mars in the ***past or prospective life in the near future***.
- The features of life discovered on the ***Red Planet like the Iron blueberries, rock outcrop and the vast similarities between these features found on Earth*** - Strong platform in our quest for an Earth like environment on Mars.
- The ***Utilization of resources*** present in the Martian atmosphere to produce ***Oxygen*** for human survival and for plant growth can be the potential sources of establishing human life on the Red Planet in the near future.
- It's impossible to say whether human can survive on Mars or not but the signs of life found on Mars gives us a ***sniff of prospective of Human Habitation*** on the Red Planet in the future.

Thank you for attention!

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